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ABSTRACT

The incremental validity of the analytical measure of the revised Graduate Record Examination (GRE) General Test, for predicting first-year graduate grade-point average (GPA), was assessed using data submitted to the GRE Validity Study Service between March 1983 and November 1984. All selected students had data for the three General Test measures (verbal, quantitative and analytical), undergraduate GPA, and first-year graduate GPA. The total sample consisted of 2,146 students in 158 departments. Regression coefficients were estimated for each of the departments using an empirical Bayes solution by shrinking to a hyperplane. Correlations were estimated for the 125 departments that had five or more students and were estimated separately for the empirical Bayes regression coefficients. Based on this study, there is little evidence that the analytical measure has any practically significant incremental validity for predicting graduate GPA over the verbal and quantitative measures of the GRE General Test, with the possible exception of Engineering and Physical-Mathematical Sciences departments. (PN)

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# The Incremental Validity of the GRE Analytical Measure for Predicting Graduate First-Year Grade-Point Average[1,2]

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[1] Based on a paper presented April 2, 1985 at the Annual Meeting of the American Educational Research Association and the National Council on Measurement in Education as part of the symposium, "The GRE Analytical Test: A New Measure for Graduate Decision Making."

[2] The programming assistance of Bruce Kaplan, Louann Benton, and Lisa Schneider and the consultation and review of my colleagues at ETS are gratefully acknowledged. The opinions expressed in this paper are solely those of the author.

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## BACKGROUND

In October 1977 an analytical ability measure was introduced as an experimental part of the GRE General Test (until October 1982 the test was referred to as the GRE Aptitude Test). The primary purpose of the addition of this measure was to broaden the definition of talent as applied to applicants to graduate school. Analyses completed in 1980 showed that the analytical measure was very susceptible to short-term practice effects and coaching (Kingston & Dorans, 1982, 1984; Powers & Swinton, 1984; Swinton & Powers 1983; Swinton, Wild, & Wallmark, 1983). These undesirable characteristics led to a substantial revision of the analytical measure in October 1981. The revised analytical measure was and currently is still considered experimental.[1] Further research was undertaken to determine if the analytical measure would be a useful tool for making graduate school admissions decisions. This paper presents one aspect of that research: the incremental validity of the GRE analytical measure for predicting graduate first-year grade-point average.[2]

## INCREMENTAL VALIDITY

In 1957 Cronbach and Gleser (page 31) wrote, "Tests should be judged on the basis of their contribution over and above the best strategy available, making use of prior information." Sechrest (1963) formalized this concept as "incremental validity." While Cronbach and Gleser were discussing personnel testing, and Sechrest was writing about clinical testing, the concept of

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[1] In 1985 the GRE Board decided that based on a comprehensive analysis of psychometrics and policy, as of October 1985 the analytical measure would be considered a fully operational part of the GRE General Test.

[2] It is clearly acknowledged that grade-point average is only one of a constellation of possible criteria, and that the predictive validity of GRE scores for other criteria are as or more important. Unfortunately, sufficient, data for other criteria are not available. See Hartnett and Willingham (1979) for a discussion of the criterion problem.

incremental validity has since been applied widely to academic selection testing (for example, Day & Day, 1983; Elterich, et al.,1975; Friedman & Bakewell, 1980; Halpin et al., 1976; Romine & Quattlebaum, 1976; Walberg & Anderson, 1972; Weitzman, 1981; Wolf, et al., 1983).

## THE GRADUATE DEPARTMENT VALIDITY CONTEXT

Determining whether or not a new measure can make a practical addition to the criterion-related validity of a set of existing measures is particularly difficult in the context of graduate department selection studies. In addition to the typical problems encountered in academic-selection predictive validity research -- most notably restriction of range due to selection effects, criterion unreliability, and compensatory selection effects (Burton & Turner, 1983; Dawes, 1975; Kingston & Livingston, 1981) -- there is the extreme problem of very small samples. Most graduate departments admit somewhere between five and twenty students a year. Even if it is deemed appropriate to combine several years of data (for example, if neither curriculum nor grading practices have changed), samples are rarely larger than fifty. For a sample of size 50, the .95 confidence interval for a .3 correlation coefficient is .02 to .53. For a sample of size 200, the .95 confidence interval is still quite large: .17 - .42. In the context of incremental validity, however, the situation is not quite so gloomy with regard to sample sizes and statistical significance. With a sample size of 50 and a multiple correlation of .3 for two predictors, to be statistically significant at the .05 level, the multiple correlation with three variables must reach .44. With sample sizes of 200 and 500, to achieve statistical significance, the multiple correlations must reach .33 and .31, respectively.

## EMPIRICAL BAYES REGRESSION

Much work has gone on in the last few decades to overcome the instability of correlations and regression coefficients based on least squares regression. Rubin (1980) developed a method -- empirical Bayes regression -- particularly appropriate when data are available from a number of samples. Braun and Jones (1981, 1985) and Braun, Jones, Rubin, and Thayer (1983) have developed variants of the basic method. Empirical Bayes regression, in the

graduate department validity context, makes use of the statistical similarities among regression systems for different departments while allowing each department to fit its own regression equation. That is, regression coefficients are shrunk towards some population value. The extent of the shrinkage is based on the stability of the departments least squares estimates and the statistical similarity of that department to the other departments in the analysis.

## INCREMENTAL VALIDITY OF THE ANALYTICAL MEASURE

The incremental validity of the analytical measure of the revised GRE General Test, for predicting first-year graduate grade-point average, was assessed using data submitted to the GRE Validity Study Service between March 1983 and November 1984. All selected students had data for the three General Test measures -- verbal (V), quantitative (Q), and analytical (A) -- undergraduate grade-point average (U), and first-year graduate grade-point average (FYA). The total sample consisted of 2,146 students in 158 departments. Regression coefficients were estimated for each of the 158 departments using an empirical Bayes solution by shrinking to a hyperplane. Technical details regarding this type of analysis can be found in Braun and Jones (1985, see model EBFf, page 26). Correlations were estimated for the 125 departments that had five or more students.[1]

To assess incremental validity of the analytical measure over the preexisting verbal and quantitative measures, correlations were estimated separately for the empirical Bayes based regression equation using V and Q as predictors and for the equation using V, Q, and A. Likewise, correlation coefficients derived from the equations based on U, V, and Q were compared with those derived from the equations based on U, V, Q, and A. Table 1 presents the weighted mean multiple correlations based on the aforementioned equations for 10 logically based groups of departments. An appendix to this paper lists the types of departments making up each group, as well as the median correlation for any department type with a total of at least 50 students.

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[1] It should be noted , that because these multiple correlations are based on empirical Bayes methods, they are more like cross-validities than original-sample validities. That is, in a sense, they are "pre-shrunk."

Insert Table 1 About Here

Table 1 shows that when the analytical measure was added to the prediction system based on the verbal and quantitative measures, the overall weighted mean correlation increased by only .01. The same result occurred when analytical was added to undergraduate grade-point average, verbal, and quantitative. Since these weighted mean correlations are based on more than 1,900 students, the increments are probably statistically significant[1], however, the practical significance of such small increments is negligible. Still, while overall the analytical measure might not add significantly to prediction, it might do so for certain types of departments. Indeed, for four of the ten department groupings the incremental validity of the analytical measure beyond the verbal and quantitative measures is more than .01; Education, .02; Research Oriented Biological Sciences, .02; Engineering, .03; and Physical & Mathematical Sciences, .04. For Research Oriented Biological Sciences the incremental validity of the analytical measure over U, V, and Q was .02. Perhaps the increment for Physical & Mathematical Sciences, and possibly even the increment for Engineering, is statistically significant at about the .05 level, the others surely are not.

It could be argued that it is unfair to place the burden of proof on the analytical measure. Perhaps the verbal and quantitative measures would fare no better in the crucible of incremental validity. To ascertain whether or not this might be so, the incremental validities of V over Q and A and of Q over V and A were assessed. Overall, Q had an incremental validity of .02 (estimated validity increased from .27 to .29). For four of the ten department groupings, Qs incremental validity was .04 or greater, including an

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[1] Methods for determining the statistical significance of weighted mean correlations based on empirical Bayes estimates are as of yet undeveloped. However, if based on least squares methods using a sample of size only 500, an increment of .01 would be statistically significant.

impressive .07 for Humanities (from .29 to .36, perhaps due to Q being relatively unaffected by restriction in range in Humanities departments). On the other hand, for three department types, Agriculture & Forestry, Engineering, and Physical & Mathematical Sciences, the addition of Q to the regression system based on V and A actually slightly lowered the multiple correlation (.01, .02, and .03, respectively).[1] Perhaps the decrement for Agriculture & Forestry should be discounted as it is based on only 50 students. The other decreases might be related to the extreme restriction in range for quantitative scores that often occurs in Engineering, and Physical & Mathematical Sciences departments.

For the verbal measure, the overall incremental validity over the quantitative and analytical measures was .06 (estimated validity increased from .23 to .29). For each of the ten department groupings it was .04 or greater.

Another way to look at the the contribution of each of the three GRE General Test measures to predicting graduate grade-point average is by comparing their regression weights. Arguments can be given to support either using standardized regression weights (taking into account differences in variances) or unstandardized regression weights (many departments directly compare scaled scores for the three General Test measures). The differences between the two approaches would probably not be too large, since for the group of 777,143 examinees who took the GRE General Test between October 1, 1981 and June 30, 1984, the standard deviations of the verbal, quantitative, and analytical measures were 130, 138, and 128, respectively. Table 2 -- based on the empirical Bayes regression equations for V, Q, and A -- presents the number of departments overall and within each department type, for which each General Test measure had the largest, second largest, or third largest unstandardized regression weight, as well as the number of times the regression weight for each measure was negative and the mean regression weight.

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[1] While such a result would not be possible if least squares regression were used, such a result, due to sampling error, is possible with empirical Bayes regression.

Insert Table 2 About Here

Several findings are evident from Table 2. Foremost, overall, the quantitative measure received the most weight for predicting first-year average, and the analytical measure received the least weight. Even in relatively non-quantitative fields such as education, psychology, and the humanities, the quantitative measure tends to have more weight in the prediction equation than either the verbal or the analytical measures. And, as might have been expected, the quantitative measure typically received the most weight in science departments. In fact, in 13 of the 14 Research Oriented Biological Sciences departments, the quantitative measure had a larger weight than both the verbal and analytical measures.

The analytical measure, on the other hand, had the smallest regression weight in 106 of the 158 departments. In fact, for 34 departments including some from each group except for Research Oriented Biological Sciences, the analytical measure had a negative weight in the regression equation. The verbal measure had a negative weight in seven studies, but these occured primarily in science departments with relatively large proportions of non-native-English speakers (approximately 43% of the Engineering sample and 21% of the Physical & Mathematical Sciences sample indicated English was not there best language). In such departments the GRE verbal measure frequently has a negative relationship with graduate grades, because in many science departments it is not unusual for foreign students to be able to compensate for their English language deficits with their great quantitative strengths.

On the other hand, in six out of eight Engineering departments, the analytical measure received a greater weight than the verbal measure. And, the average regression weight for the analytical measure was greater than that for the verbal measure for three department groupings: Research Oriented Biological Sciences, Engineering, and Physical & Mathematical Sciences.

## REANALYSIS WITH ONLY NATIVE-ENGLISH SPEAKING STUDENTS

To investigate further the effect of the inclusion of non-Native-English speakers, the empirical Bayes analysis was rerun on the data from those examinees who claimed English was there best language. Table 3, based on 1,689 students in 155 departments (a reduction of the 256 students, for whom English is not the best language, from the previous analysis) and Table 4, based on 1,859 students in 155 departments (a reduction of 287 students from the previous similar analysis) present the incremental validity data, and the rank, number of negative coefficients and mean coefficients for this subset of students, respectively.

Table 3 shows that when non-Native English speakers are removed from the analysis, the analytical measure fares no better in terms of incremental validity. The multiple correlation over all departments still goes up only .01 when analytical is added to the regression equation based on verbal and quantitative. The only department type for which the increment was greater than .02 was Education, and this was based on a sample of only 155. The increase in multiple correlation when analytical was added to the regression equation based on undergraduate grade-point average, verbal, and quantitative was less than .01. For no department type was the incremental validity greater than .02.

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Insert Tables 3 and 4 About Here

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Table 4 presents a somewhat different picture. Although the mean regression coefficient did not change for the analytical measure, those for the verbal and quantitative measures were slightly lower than they had been in the total group analysis. Of greater interest, the analytical measure has the lowest of the three coefficients in only 55% of the departments (compared to 67% in the original analysis, and the approximately 33% that would have occured if the three measures were of equal value in predicting graduate first-year average).

Particularly striking, the average weight given the analytical measure is now essentially equal to that of the quantitative measure for Education and Medically Oriented Biological Sciences departments. Also, for this group of students who claimed English was there best language, the verbal measure gets essentially no weight in the prediction equations for Engineering and Physical & Mathematical Sciences departments. For Engineering departments the mean coefficient is actually negative.

## DISCUSSION AND SUMMARY

Based on this study, there is little evidence that the analytical measure has any practically significant incremental validity for predicting graduate grade-point average over the verbal and quantitative measures of the GRE General Test, with the possible exception of Engineering and Physical & Mathematical Sciences departments. And, even in those departments, when undergraduate grade-point average is used in the prediction equation, the incremental validity of the analytical measure dissipates. The likely reason for these findings is the relatively high correlation that the analytical measure has with the verbal and quantitative measures. In a sample of 369,033 examinees who indicated that they were either seniors or had graduated from college within the past five years, but had never enrolled in graduate school, the intercorrelations among the three General Test Measures were: $r_{VA} = .65$; $r_{QA} = .68$; and $r_{VQ} = .49$ (ETS, 1984).

Another factor that may have influenced these results is the relatively low reliability of some of the early editions of the revised analytical measure. While the estimated reliability[1] of the verbal and quantitative measures have been fairly consistant at about .92 and .91, respectively, four of the first five editions of the revised experimental analytical measure had

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[1] Reliability estimates for the GRE General Test are derived by first estimating the SEM of item types within sections using KR-20, then subtracting the ratio of total error variance to observed score variance from one.

estimated reliabilities between .84 and .86. The difficulties encountered in developing a reliable analytical measure were due, in part, to an initial item pool that was too difficult for the intended population and an inability, due to administrative constraints, to get optimal pretest information. These issues are no longer of concern, and the most recent editions of the measure, with one exception, have had reliabilities of .89 to .90. As more data based on later, more reliable editions of the analytical measure become available this incremental validity study should be replicated.

The incremental validity of the analytical measure may be greater for predicting other important criteria, but sufficient data to evaluate this are not yet available.

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## APPENDIX

### Median Correlations for Department Groupings and Constituent Departments and Their Median Correlations[1]

| NAME | NUMBER DEPT | TOTAL PEOPLE | VQ | VQA | VQU | VQUA |
|---|---|---|---|---|---|---|
| EDUCATION | 12 | 184 | .29 | .31 | .38 | .39 |
| Ed. Administration | 2 | 20 | | | | |
| Education (incl MA in Teach) | 8 | 123 | .26 | .27 | .37 | .37 |
| Physical Education | 2 | 41 | | | | |
| PSYCHOLOGY, GUIDANCE, & COUNSELING | 22 | 271 | .27 | .29 | .33 | .32 |
| Psychology, Other | 2 | 20 | | | | |
| Psychology, Educational | 1 | 12 | | | | |
| Psychology, Clinical | 15 | 196 | .28 | .30 | .31 | .32 |
| Guidance & Counseling | 4 | 43 | | | | |
| MANAGEMENT ORIENTED SOCIAL SCIENCES | 7 | 203 | .29 | .32 | .36 | .38 |
| Business & Commerce | 1 | 13 | | | | |
| Public Administration | 5 | 183 | .29 | .32 | .36 | .38 |
| Planning (City, Comm., Urb.) | 1 | 7 | | | | |
| RESEARCH ORIENTED BIOLOGICAL SCIENCES | 10 | 127 | .23 | .24 | .28 | .30 |
| Pharmacology | 1 | 6 | | | | |
| Genetics | 1 | 11 | | | | |
| Microbiology | 2 | 25 | | | | |
| Other Biological Sciences | 1 | 23 | | | | |
| Biochemistry | 1 | 11 | | | | |
| Biology | 2 | 22 | | | | |
| Zoology | 2 | 29 | | | | |
| MEDICALLY ORIENTED BIOLOGICAL SCIENCES | 7 | 125 | .26 | .29 | .34 | .34 |
| Audiology | 1 | 15 | | | | |
| Nursing | 3 | 40 | | | | |
| Physical Therapy | 1 | 33 | | | | |
| Speech-Lang. Pathology | 1 | 29 | | | | |
| Nutrition | 1 | 8 | | | | |
| AGRICULTURE & FORESTRY | 4 | 50 | .22 | .23 | .36 | .36 |
| Agriculture | 2 | 34 | | | | |
| Forestry | 2 | 16 | | | | |

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[1] Median correlations are provided only for department types with a total of at least 50 students.

APPENDIX (Continued)

| NAME | NUMBER DEPT | TOTAL PEOPLE | VQ | VQA | VQU | VQUA |
|---|---|---|---|---|---|---|
| ENGINEERING | 8 | 148 | .15 | .20 | .33 | .34 |
| Engineering, Aeronautical | 1 | 6 | | | | |
| Engineering, Chemical | 1 | 22 | | | | |
| Engineering, Civil | 1 | 30 | | | | |
| Engineering, Electrical | 1 | 8 | | | | |
| Engineering, Mechanical | 2 | 47 | | | | |
| Engineering, Other | 2 | 35 | | | | |
| PHYSICAL & MATHEMATICAL SCIENCES | 13 | 178 | .16 | .21 | .34 | .34 |
| Statistics | 1 | 5 | | | | |
| Other Physical Sciences | 1 | 12 | | | | |
| Astronomy | 1 | 7 | | | | |
| Chemistry | 5 | 74 | .16 | .20 | .34 | .33 |
| Geology | 3 | 63 | .19 | .21 | .33 | .34 |
| Oceanography | 1 | 6 | | | | |
| Physics | 1 | 11 | | | | |
| HUMANITIES | 13 | 261 | .34 | .36 | .45 | .46 |
| English | 3 | 32 | | | | |
| Music | 1 | 17 | | | | |
| Philosophy | 1 | 7 | | | | |
| Religious Studies or Religion | 6 | 185 | .35 | .37 | .48 | .49 |
| Speech | 1 | 9 | | | | |
| Other Humanities | 1 | 11 | | | | |
| MISCELLANEOUS | 29 | 398 | .33 | .32 | .42 | .43 |
| Journalism | 1 | 10 | | | | |
| American Studies | 1 | 23 | | | | |
| Geography | 1 | 14 | | | | |
| Other Social Sciences | 8 | 186 | .30 | .30 | .42 | .42 |
| Communications | 2 | 33 | | | | |
| Economics | 3 | 71 | .19 | .24 | .31 | .35 |
| History | 4 | 41 | | | | |
| International Relations | 1 | 5 | | | | |
| Library Science | 2 | 22 | | | | |
| Political Sci/Govern | 3 | 29 | | | | |
| Home Economics | 1 | 6 | .16 | .17 | .42 | .37 |

Table 1

Incremental Validity
as Determined by Increase in Weighted Mean Correlations

| Department Grouping | Number of Depts. | Total Students | VQ[1] | VQA[2] | UVQ[3] | UVQA[4] |
|---|---|---|---|---|---|---|
| All Departments | 125 | 1945 | .28 | .29 | .38 | .39 |
| Education | 12 | 184 | .29 | .31 | .41 | .42 |
| Psychology, Guidance, & Counseling | 22 | 271 | .29 | .29 | .33 | .33 |
| Management Oriented Social Sciences | 7 | 203 | .33 | .33 | .38 | .38 |
| Research Oriented Bio. Sciences | 10 | 127 | .24 | .26 | .29 | .31 |
| Medically Oriented Bio. Sciences | 7 | 125 | .24 | .25 | .33 | .33 |
| Agriculture & Forestry | 4 | 50 | .22 | .23 | .33 | .34 |
| Engineering | 8 | 148 | .16 | .19 | .34 | .35 |
| Physical & Mathematical Sciences | 13 | 178 | .17 | .21 | .34 | .35 |
| Humanities | 13 | 261 | .35 | .36 | .47 | .48 |
| Miscellaneous | 29 | 398 | .33 | .34 | .42 | .43 |

[1]Regression based on verbal and quantitative scores.

[2]Regression based on verbal, quantitative and analytical scores.

[3]Regression based on undergraduate grade-point average, verbal, and quantitative scores.

[4]Regression based on undergraduate grade-point average, verbal, quantitative, and analytical scores.

Table 2

Rank, Number of Negative Coefficients, and Mean Regression Coefficients for Each of Ten Department Groupings

| Department Grouping (# of Departments) | Rank of Regression Coefficient: First | | | Second | | | Third | | | Number Negative | | | Mean Coefficient[1] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | Q | A | V | Q | A | V | Q | A | V | Q | A | V | Q | A |
| Education (13) | 6 | 7 | 0 | 7 | 6 | 0 | 0 | 0 | 13 | 0 | 0 | 6 | 2.0 | 1.9 | 0.1 |
| Psychology, Guidance, & Counseling (29) | 13 | 14 | 2 | 10 | 13 | 6 | 6 | 2 | 21 | 1 | 0 | 5 | 1.5 | 1.7 | 0.6 |
| Management Oriented Social Sciences (8) | 2 | 5 | 1 | 4 | 3 | 1 | 2 | 0 | 6 | 0 | 0 | 1 | 1.4 | 1.6 | 0.6 |
| Research Oriented Bio. Sciences (14) | 0 | 13 | 1 | 7 | 1 | 6 | 7 | 0 | 7 | 1 | 0 | 0 | 0.8 | 1.7 | 1.0 |
| Medically Oriented Bio. Sciences (10) | 5 | 5 | 0 | 4 | 5 | 1 | 1 | 0 | 9 | 0 | 0 | 4 | 1.9 | 1.9 | 0.2 |
| Agriculture & Forestry (4) | 1 | 3 | 0 | 0 | 1 | 3 | 3 | 0 | 1 | 0 | 0 | 1 | 1.2 | 1.6 | 0.7 |
| Engineering (8) | 1 | 6 | 1 | 1 | 2 | 5 | 6 | 0 | 2 | 3 | 0 | 1 | 0.4 | 1.4 | 1.1 |
| Physical & Mathmatical Sciences (17) | 2 | 10 | 5 | 3 | 7 | 7 | 12 | 0 | 5 | 2 | 0 | 2 | 0.8 | 1.4 | 0.9 |
| Humanities (17) | 6 | 9 | 2 | 5 | 8 | 4 | 6 | 0 | 11 | 0 | 0 | 2 | 1.5 | 2.0 | 0.6 |
| Miscellaneous (38) | 21 | 17 | 0 | 11 | 20 | 7 | 6 | 1 | 31 | 0 | 0 | 12 | 1.8 | 1.8 | 1.0 |
| All Departments (158) | 57 | 89 | 12 | 52 | 66 | 40 | 49 | 3 | 106 | 7 | 0 | 34 | 1.4 | 1.7 | 0.6 |

[1] Regression coefficients are scaled to predict FYA standardized within department. Tabled values are equal to actual coefficients multiplied by 1,000.

Table 3

Incremental Validity
as Determined by Increase in Weighted Mean Correlations
for Examinees Who Claimed That English Was Their Best Language

| Department Grouping | Number of Depts. | Total Students | VQ[1] | VQA[2] | UVQ[3] | UVQA[4] |
|---|---|---|---|---|---|---|
| All Departments | 115 | 1,689 | .26 | .27 | .38 | .38 |
| Education | 11 | 155 | .26 | .30 | .40 | .42 |
| Psychology, Guidance, & Counseling | 19 | 235 | .25 | .27 | .32 | .33 |
| Management Oriented Social Sciences | 7 | 199 | .31 | .31 | .37 | .37 |
| Research Oriented Bio. Sciences | 10 | 120 | .21 | .21 | .29 | .30 |
| Medically Oriented Bio. Sciences | 7 | 118 | .22 | .23 | .33 | .34 |
| Agriculture & Forestry | 4 | 41 | .20 | .22 | .32 | .34 |
| Engineering | 8 | 94 | .10 | .11 | .35 | .34 |
| Physical & Mathematical Sciences | 10 | 139 | .15 | .15 | .35 | .35 |
| Humanities | 13 | 248 | .32 | .34 | .46 | .48 |
| Miscellaneous | 26 | 340 | .31 | .31 | .38 | .39 |

[1]Regression based on verbal and quantitative scores.

[2]Regression based on verbal, quantitative and analytical scores.

[3]Regression based on undergraduate grade-point average, verbal, and quantitative scores.

[4]Regression based on undergraduate grade-point average, verbal, quantitative, and analytical scores.

Table 4

Rank, Number of Negative Coefficients, and Mean Regression Coefficients for Each of Ten Department Groupings for Examinees Who Claimed That English Was Their Best Language

| Department Grouping (# of Departments) | Rank of Regression Coefficient: First | | | Second | | | Third | | | Number Negative | | | Mean Coefficient[1] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V | Q | A | V | Q | A | V | Q | A | V | Q | A | V | Q | A |
| Education (13) | 10 | 3 | 0 | 3 | 3 | 7 | 0 | 7 | 6 | 0 | 2 | 0 | 2.1 | 0.8 | 1.0 |
| Psychology, Guidance, & Counseling (27) | 9 | 18 | 0 | 18 | 4 | 5 | 0 | 5 | 22 | 0 | 0 | 5 | 1.6 | 1.8 | 0.4 |
| Management Oriented Social Sciences (7) | 2 | 5 | 0 | 4 | 2 | 1 | 1 | 0 | 6 | 0 | 0 | 2 | 1.1 | 2.0 | 0.3 |
| Research Oriented Bio. Sciences (14) | 2 | 12 | 0 | 7 | 1 | 6 | 5 | 1 | 8 | 2 | 0 | 0 | 0.6 | 1.7 | 0.5 |
| Medically Oriented Bio. Sciences (10) | 8 | 2 | 0 | 2 | 2 | 6 | 0 | 6 | 4 | 0 | 1 | 0 | 1.8 | 0.9 | 1.0 |
| Agriculture & Forestry (4) | 1 | 3 | 0 | 2 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 1 | 1.0 | 1.7 | 0.5 |
| Engineering (8) | 0 | 6 | 2 | 1 | 1 | 6 | 7 | 1 | 0 | 7 | 1 | 0 | -0.3 | 1.5 | 0.6 |
| Physical & Mathematical Sciences (17) | 1 | 13 | 3 | 5 | 1 | 11 | 11 | 3 | 3 | 4 | 2 | 4 | 0.2 | 1.7 | 0.5 |
| Humanities (17) | 9 | 8 | 0 | 8 | 5 | 4 | 0 | 4 | 13 | 0 | 2 | 5 | 1.9 | 1.8 | 0.4 |
| Miscellaneous (38) | 21 | 17 | 0 | 15 | 7 | 16 | 2 | 14 | 22 | 0 | 4 | 4 | 1.8 | 1.4 | 0.7 |
| All Departments (155) | 63 | 87 | 5 | 65 | 26 | 64 | 27 | 42 | 86 | 13 | 12 | 21 | 1.3 | 1.5 | 0.6 |

[1] Regression coefficients are scaled to predict FYA standardized within department. Tabled values are equal to actual coefficients multiplied by 1,000.